

CLAIMS

1. An optical transmission system comprising at least a first and a second terminal station, optically connected with each other by an optical link, said first or said second terminal station being adapted to send on said optical link at least a first optical signal having a first direction, said system further comprising:
- 5
- at least a first pump source disposed along said optical link, said pump source being adapted to send on said optical link a pump radiation in said first direction, so as to cause Raman amplification of said first optical signal;
 - 10
 - at least one device disposed along said optical link;
- characterized in that said device comprises:
- at least a first photodetector adapted for converting a portion of said first optical signal in an electrical signal,
 - 15
 - a first supervisory unit adapted for amplifying said electrical signal, for extracting a first supervisory signal from said electrical signal, and for feeding said extracted amplified first supervisory signal to at least a first modulator connected to said optical link or to a driving circuit of said pump source, so as to superimpose said extracted amplified first supervisory signal on said first optical signal.
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2. An optical transmission system according to claim 1, characterized in that said first supervisory signal comprises at least an information signal on an operating state of said device.
3. An optical transmission system according to claim 1 or 2, characterized in that said device disposed along said optical link is a repeater and said at least first pump source is comprised in said repeater.
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4. An optical transmission system according to claim 3, characterized in that said first supervisory unit is associated to said first pump source.

5. An optical transmission system according to any one of the preceding claims, characterized in that said modulator is a lithium niobate modulator.
6. An optical transmission system according to any one of claims 1 to 4, characterized in that said modulator is a semiconductor modulator.
- 5 7. An optical transmission system according to any one of claims 1 to 4, characterized in that said modulator is a tunable band-pass filter.
8. An optical transmission system according to any one of claims 1 to 4, characterized in that said modulator is a variable optical attenuator.
9. An optical transmission system according to claim 8, characterized in that said
10 variable optical attenuator is a magneto-optical variable attenuator.
10. An optical transmission system according to any one of the preceding claims, characterized in that said optical link comprises at least a first optical fiber and a second optical fiber, said first optical fiber being adapted to carry said first optical signal in said first direction and said second optical fiber being adapted
15 to carry a second optical signal in a second direction, opposite to said first direction.
11. An optical transmission system according to claim 10, characterized in that said device comprises at least a second pump source, said second pump source being adapted to send on said second optical fiber a pump radiation in
20 said second direction, so as to cause Raman amplification of said second optical signal.
12. An optical transmission system according to claim 11, characterized in that said device comprises at least a second photodetector, adapted for converting a portion of said second optical signal in a second electrical signal.
- 25 13. An optical transmission system according to claim 12, characterized in that said first supervisory unit is adapted for amplifying said second electrical signal, for extracting a second supervisory signal from said second electrical signal, and for feeding said extracted amplified second supervisory signal to at least a second modulator connected to said second optical fiber or to a driving

circuit of said second pump source, so as to superimpose said extracted amplified second supervisory signal on said second optical signal.

14. An optical transmission system according to any of the preceding claims, characterized in that said first supervisory unit is adapted for generating at least a third supervisory signal, and for feeding said third supervisory signal to a driving circuit of said first or second pump source or to said first or said second modulator, so as to superimpose said third supervisory signal on said first or second optical signal.
15. An optical transmission system according to any one of the preceding claims, characterized in that said first or said second terminal station comprises a second supervisory unit, being adapted to receive at least a portion of said first or said second optical signal from said optical link and discriminate from said first or said second optical signal said first, second or said third supervisory signal.
16. An optical transmission system according to claim 15, characterized in that said second supervisory unit is adapted to generate a fourth supervisory signal to be superimposed on said first or said second optical signal.
17. An optical transmission system according to any one of the preceding claims, characterized in that said first or said second optical signal is a WDM optical signal.
18. An optical transmission system according to claim 17, characterized in that said first or said second terminal station comprises a plurality of transmitters being adapted to emit a respective plurality of optical signals having different wavelengths, and a multiplexing device being adapted to multiplex said plurality of optical signal having different wavelengths in said WDM optical signal.
19. An optical transmission system according to claim 18, characterized in that said first or said second terminal station comprises a transmitter optical amplifier.

20. An optical transmission system according to claim 15 and 19, characterized in that said second supervisory unit is associated to said transmitter optical amplifier, so that said fourth supervisory signal is adapted to modulate a gain of said transmitter optical amplifier.
- 5 21. An optical transmission system according to claim 20, characterized in that said transmitter optical amplifier is a co-propagating Raman amplifier.
22. An optical transmission system according to any one of claims 15 to 19, characterized in that said first or said second terminal station comprises at least a third modulator, said second supervisory unit being associated to said
10 third modulator in order to superimpose said fourth supervisory signal to said first or said second optical signal.
23. An optical transmission system according to claim 22, characterized in that said third modulator is a variable optical attenuator.
24. An optical transmission system according to claim 23, characterized in that
15 said third modulator is a magneto-optical variable attenuator.
25. An optical repeater comprising at least a first optical fiber adapted to carry a first optical signal in a first direction, at least a first pump source connected to said first optical fiber, said first pump source being adapted to send on said first optical fiber a pump radiation in said first direction, so as to cause Raman
20 amplification of said first optical signal;
- characterized in that it further comprises
- at least a first photodetector adapted for converting a portion of said first optical signal in an electrical signal,
 - a first supervisory unit adapted for amplifying said electrical signal, for
25 extracting a first supervisory signal from said electrical signal, and for feeding said extracted amplified first supervisory signal to at least a first modulator connected to said first optical fiber or to a driving circuit of said first pump source, so as to superimpose said extracted amplified first supervisory signal on said first optical signal.

26. An optical repeater according to claim 25, characterized in that said first supervisory unit is associated to said first pump source.
27. An optical repeater according to claim 25 or 26, characterized in that said modulator is a lithium niobate modulator.
- 5 28. An optical repeater according to claim 25 or 26, characterized in that said modulator is a semiconductor modulator.
29. An optical repeater according to claim 25 or 26, characterized in that said modulator is a tunable band-pass filter.
- 10 30. An optical repeater according to claim 25 or 26, characterized in that said modulator is a variable optical attenuator.
31. An optical repeater according to claim 30, characterized in that said variable optical attenuator is a magneto-optical variable attenuator.
- 15 32. An optical repeater according to any one of claims 25 to 31, characterized in that said repeater comprises at least a second pump source connected to a second optical fiber adapted to carry a second optical signal in a second direction, opposite to said first direction, said second pump source being adapted to send on said second optical fiber a pump radiation in said second direction, so as to cause Raman amplification of said second optical signal.
- 20 33. An optical repeater according to claim 32, characterized in that said it further comprises at least a second photodetector, adapted for converting a portion of said second optical signal in a second electrical signal.
- 25 34. An optical repeater according to claim 33, characterized in that said first supervisory unit is adapted for amplifying said second electrical signal, for extracting a second supervisory signal from said second electrical signal, and for feeding said extracted amplified second supervisory signal to at least a second modulator connected to said second optical fiber or to a driving circuit of said second pump source, so as to superimpose said extracted amplified second supervisory signal on said second optical signal.

35. An optical repeater according to any of claims 25 to 34, characterized in that said first supervisory unit is adapted for generating at least a third supervisory signal, and for feeding said third supervisory signal to a driving circuit of said first or second pump source or to said first or said second modulator, so as to
5 superimpose said third supervisory signal on said first or second optical signal.

36. A method for supervising an optical transmission system comprising an optical link between at least a first and a second terminal station, said method comprising:

- transmitting a first optical signal on said optical link in a first direction;
- 10 - sending on said optical link a pump radiation in said first direction, so as to cause Raman amplification of said first optical signal;

characterized in that said method further comprises:

- converting, in a point along said optical link, a portion of said first optical signal in an electrical signal,
- 15 - amplifying said electrical signal
- extracting a supervisory signal from said electrical signal; and
- superimposing said extracted amplified supervisory signal on said first optical signal.